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PROSPECTING IN NEW BRUNSWICK (SESSION V)

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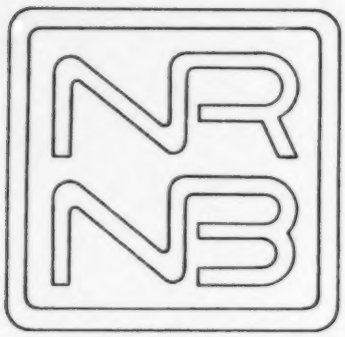
PROSPECTING IN NEW BRUNSWICK
(SESSION V)



Mineral Resources Division
Department of Natural Resources
New Brunswick

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Notes on

PROSPECTING IN NEW BRUNSWICK

BY

W.E. Hale

SESSION FIVE

Field Methods and Sampling

February, 1981

Revised January, 1982

Notes on
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W.E. Hale

SESSION FIVE

Field Methods and Sampling

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Notes on
PROSPECTING IN NEW BRUNSWICK
W.E. Hale

SESSION FIVE
(of six)

FIELD METHODS AND SAMPLING

5.1.0 FIELD METHODS

5.1.1 Introduction

Field methods are, naturally, best learned in the field. A useful practice for the beginner is to work, for some time, with an experienced prospector or with a company employing teams of specialists engaged in mineral exploration.

'Prospecting' and 'mineral exploration' are essentially the same. 'Prospecting' is usually thought of in the traditional sense of the individual, basically equipped, non-professional, operating alone and depending chiefly on diligence and luck in areas where little or no prospecting has been done before. 'Mineral exploration', commonly refers to more scientifically trained teams of professional specialists and their assistants, operating with more expensive, sophisticated equipment and relatively large budgets, over large areas in which they depend partly on methods not previously tested in the same area. The objective of finding ore is common to both and there is a similarity between being there first on foot or being there first with a new method.

There are probably as many approaches to prospecting (individual or corporate) as there are those preparing prospecting programs.

Circumstances that influence prospecting methods and plans include:

location
climate
local geology
budget
access
knowledge
previous prospecting history
government policy
tme available

For the purposes of these notes, prospecting by the individual, or small team, will be stressed.

More detailed information can be found in your text (Lang, 1970) which is devoted primarily to this topic (pp. 78-206 inclus.). Since this reference (Lang) deals with prospecting in Canada as a whole, a few additional comments for New Brunswickers will be presented here.

Prospectors should understand that their work is considered by others as important in, and necessary for, the growth of the mineral industry. For this reason, the prospector is not now the lonely, isolated individual of the past. Government departments, research organizations, public libraries, universities and mining companies will all assist the prospector, primarily with information. (Some provinces in Canada provide direct assistance in the form of equipment and transportation).

5.1.2 Prefield Planning and Organization

This prospecting program itself represents an initial step in organizing for actual work in the field. The text, manual, references, and notes may be considered a nucleus of geological and related information that will serve as 'background' for the prospector.

For most prospectors in New Brunswick, some limitations will influence planning and organization. Generally, the prospector will wish to work from his/her home and thus the area of interest, the geology, means of transportation, etc. will be partly predetermined. If prospecting is to be a 'weekend and holidays', part-time occupation or hobby, the range or distance from the 'base' will also be fairly restricted.

The first step in organizing an intelligent prospecting effort is to obtain all the information available for the area in which work is to be done. This information in N.B. includes:

a) general and detailed geological maps
b) mineral occurrence maps
c) claim map(s)
d) topographic maps
e) aerial photographs
f) aeromagnetic maps
g) aeroradiometric maps
h) geochemical maps
i) assessment data filed with the Mineral Resources Division by previous workers in the area
j) other specialized information on: soils, commodity reports, university theses, etc.

Most of this information can be obtained in the offices of the Department of Natural Resources (Fredericton, Bathurst,

Sussex) and guidance to other information, not available there, will be provided.

Qualified, and interested government geologists will assist the prospector in obtaining and using the appropriate information. Whereas public service scientists are willing to assist prospectors, they should not be considered as private tutors or consultants. The prospector has to make an effort to familiarize him/herself with the information and the use to which it can be part.

Of particular value in planning for field work are the 'assessment files'. Individuals and companies taking up ground, under a N.B. prospecting license, are required to file with the Department of Natural Resources (Mineral Resources Division) reports of work carried out on their ground. This information is available and the prospector should learn to use it so that his/her work does not repeat, in a wasteful fashion, the work already done by others.

The beginning prospector should not feel discouraged or overwhelmed by the quantity and complexity of the data available for the area of his/her interest. The ability to use this information will grow with experience. For reasons already described, it should also be appreciated that this published, or otherwise available, data may be useful in terms not only of the information it gives, but also for indicating (in the case of geological maps particularly) where information is uncertain or lacking. It may be worth repeating here that geological mapping is not prospecting.

When available information, or the pertinent parts of it,

have been collected or copied, the prospector might proceed along the following lines:

a) On a sheet(s) of transparent paper or film over the map or air photo(s) covering the area of interest, begin compiling (transferring, copying, tracing) information (from all available sources) that may have prospecting significance (outcrops, locations, geological boundaries, faults, major rock types, known mineral or mineral fuel occurrences, access routes, location fixes, (prominent features on the ground that can be used for reference), earlier sample analyses, etc.). Where information is abundant, more than one transparent sheet may be used and specific types of information may be confined to individual transparent layers (overlays). These may be 'stacked' in various combinations to give useful comparisons of data. Scales of maps from which the information is taken will vary and the prospector will have to acquire practice in transferring from one scale to another. The prospector's own compilation of available information may have a scale equal to the most detailed source of information he has. This may be the aerial photographs of his/her area of interest.

The location of known mineralization, ore occurrences, and the claims held by others should be carefully plotted. Similarly, areas excluded from prospecting (parks, cemeteries, etc.) should be identified on the prospector's 'compilation'.

b) When known (by anyone) mineralization is located on the compilation, the prospector should then consider: a) Are there geological, topographic or other features (whatever their origin, which may not be understood) confined to, or characteristic of,

the known occurrences. b) Do these 'features', 'patterns', 'indicators', etc. all, or in part, occur elsewhere in the area and, thus, indicate possible sites for mineralization not previously found by others. Air photos should be examined carefully for this purpose. New Brunswick is mostly covered with vegetation and outcrop of bedrock is scarce. Subtle or inconspicuous features may appear on the air photos, at and near ore mineral locations. Those accustomed to working elsewhere in Canada may not be familiar with, or experienced in, surface conditions as they are here. Thus, even the beginning prospector may see 'anomolous' features (intersection of ridges, changes in vegetation, 'ledges', shades of soil, etc.) that could be missed by others.

When there is known ore mineralization or mines in an area of interest and the prospector has determined the features that may serve as guides to additional occurrences of the same type, he/she should: i) try to find out, even in a general way, how much and what kinds of earlier prospecting have been done in the area of interest, especially if the features (patterns, indicators) associated with the known occurrences are obvious, ii) obtain some information on the size, shape, and grade of the known ore mineral occurrences, iii) decide whether or not additional work is justified. It should be appreciated by the prospector that new information in the form of geological, geophysical, geochemical maps and reports or a new type of occurrence may make what was considered a thoroughly prospected area 'new' or 'virgin'. This is commonly the cause of 'rushes' in well known areas.

c) When potentially favourable ground is indicated (by whatever means) in an area of known occurrences, the prospector should plan traverses (routes) on the compilation which he/she will later follow on the ground. These should be planned to 'tie in' to points on the air photos or maps so that location will not be a serious or time-consuming problem. The prospector should also consider, in these cases, the size of the known occurrences and the previous history of discovery and arrange the 'density' of his/her traverses accordingly, so that a surface indication of a 'new' occurrence of the known type is not likely to be missed. Prospectors should realize that much modern prospecting is done rapidly, by what are called 'scanning' (e.g. airborne geophysical, reconnaissance geochemical) methods designed to cover large areas rapidly, using instruments and operators on a predetermined grid. These methods, while having many advantages, lack the flexibility and opportunity for careful on-the-spot follow-up of 'leads' that characterize the field work of the individual prospector.

It is best to arrange traverses before field work and 'stick' to them (within reason of course) rather than wander about the area of interest. (Unless a system of traverses is organized, the prospector will sometimes tend to follow 'the paths of least resistance' in the field, i.e. parallel to valleys, open areas, game trails, etc., along which outcrop may be less abundant than average for the area. Furthermore, these 'paths of least resistance' are likely to be those along which earlier prospectors have already travelled).

d) For most areas of N.B., some ore mineral occurrences are

already known. (By now it should be appreciated that by the term, "ore mineral occurrences" we do not mean "ore"). In areas where there are no known ore mineral occurrences, or past experience of others indicates that the known occurrences are now unattractive as prospecting 'targets', the prospector should consider 'new targets', based on the geology of an area and his/her knowledge of ore occurrences elsewhere that occur in geological environments that appear to, or may, exist in his/her N.B. area. This type of analysis or interpretation is being done continually by the best qualified and most experienced exploration geologists and prospectors in major mining companies but the possibilities have not been exhausted and the individual prospector, 'on the ground', has some advantages in local lore, interest and direct experience.

"Where do I start?", is a legitimate and logical question for the beginning prospector planning field work in an area of no known occurrences (or one in which the economic possibilities of the known occurrences appear to have been exhausted by previous investigations). The best starting point is by learning about mineral deposits and the geological environments in which they commonly occur. Your texts (Lang, 1970) will serve as an introduction to mineral deposits (although the text does not provide a very practical guide for what is required here). A more detailed and systematic review of this basic knowledge is presented, in a somewhat more advanced form, in Reference 9, (Peters, Exploration and Mining Geology, Chapters 2 and 3, pp. 17-119 inclus.).

"Geology and Economic Minerals of Canada", your Reference 4,

is ideal as a source of information on the subjects indicated by its title. Special attention to the "Appalachian Region" in this reference is a 'must' for the New Brunswick prospector. Reference 11 catalogues the mineral occurrences in the Atlantic area, primarily from the collector's point of view, but this approach serves the prospector for basic data on location, history, and general geological environment.

Other references are available in government, public and university libraries. The serious prospector should make the knowledge of mineral deposits, local and general, a subject of continuing study throughout his/her active career.

As suggested above, there is still scope for this type of prospecting in New Brunswick. Most of the geological formations depicted on the Geological Map of N.B. have a complex geological history in which ore mineralization of various types and times may have been included. The scarcity of outcrop and the lack of earlier information account for the late discovery of some ore deposits (e.g. Bathurst). Future discoveries of a wide variety of ore minerals is entirely possible in the many geological environments known here. For example, the ore in the Bathurst-Newcastle area is known now to occur in volcanic and sedimentary rocks of a certain geological age range (see Geological Map of New Brunswick.). Volcanic and sedimentary rocks, not unlike those in Bathurst-Newcastle, and of similar or uncertain age, are known to occur in other parts of New Brunswick and therefore could (in terms of geological environments) be the hosts for other economic, massive sulphide deposits, like those in the Bathurst-Newcastle area.

Uranium deposits, in western U.S.A., occur in sedimentary

rocks that resemble, in many respects, Carboniferous rocks that are widespread in New Brunswick.

The arrangement of traverses in apparently untested areas should be such that geological features: outcrops, contacts between rock types, faults, fold axes, magnetic anomalies, geochemical 'highs' and any other anomalous features, including topographic and vegetation irregularities, are 'crossed' as often as possible, at least until mineralization is identified. These features are the most likely to be related to, or part of, the anomalous crustal or surface conditions with which all ore deposits are associated.

When the traverse plan is selected from the compilation, the prospector should organize a schedule of time and the resources (vehicle, equipment, time) required to follow the plan.

5.1.3 Equipment and Travel

Lang (1970) discusses equipment and means of travel (p. 82) for prospecting in Canada generally. This advice will be modified by local experience and conditions.

Most of N.B. is accessible by vehicle and foot in contrast to other parts of Canada where more expensive means of travel and thus, longer stays 'in the bush' are required for economy and efficiency.

Vehicles with 4-wheel drive and light-weight camping gear extend the range of the local prospector and allow access to areas where less prospecting has already been done.

Prospecting in areas away from telephones, well-travelled roads or other means of emergency contact should always be done

in the company of another person.

Advice from local residents of an area or other prospectors, geologists, foresters, lumbermen, sportsmen, guides, etc. will provide the best guidance on equipment, clothing, travel etc. Experience will indicate the modifications required for your purpose.

Prospectors should include with their equipment at all times, the maps, air photos, compass and related means of maintaining careful control of their location. This is desirable, from the point of view of efficient use of their time, but also a serious prospector will want to be certain of the location of samples, outcrops, and other observations he/she makes in the field. This is fundamental to the prospector's ability to collect useful information for him-/herself and for others with whom later negotiations for sale, option, etc. may be involved. Those who cannot locate themselves in the field should not prospect.

5.1.4 Geological Methods

Geology has been introduced as a basis for intelligent prospecting in earlier sessions of this program.

Your text (Lang, 1970) deals with this subject (Chapters 8, 9 & 10). A more advanced treatment of this subject is available in Reference 9.

5.1.5 Geophysical Methods

Geophysical methods used in prospecting are described by Lang (1970) in your texts. This description of methods and

instruments will be more than adequate for this introductory program. (The instructor may demonstrate one or more of the instruments commonly used by prospectors). Reference 9 (Chapters 13, p. 363) provides a more up-to-date review of exploration geophysics.

New Brunswick prospectors will know of the availability of aeromagnetic and aeroradiometric maps available in this province by contacting the Department of Natural Resources, Mineral Resources Division. Other geophysical data is available for specific areas and methods (e.g. Sussex, gravity) in reports, by government professionals and company crews. Geophysical data is also abundantly available in the assessment files referred to earlier.

Some specialized instruction and practice, preferably in the field, are required for an understanding and prospecting application of most geophysical methods and results. The beginning prospector should have a general idea of aeromagnetic maps and their use to indicate magnetically anomalous conditions in the crust. It should also be possible to understand and use a radiation counter for uranium prospecting.

5.1.6 Geochemical Methods

The basic description of geochemical prospecting provided in your texts will not be repeated here. Although the description (Lang, 1970) is somewhat out-of-date, it will serve the beginning prospector. Reference 9 (Chapter 14, p. 397) gives a more modern summary of this important field method and references cited there (p. 428) will satisfy the needs of all but the most advanced prospector.

Of particular interest to New Brunswickers is the condition and characteristics of our soil as it was, and is, affected by our glacial history. Geochemical survey reports on both unconsolidated and consolidated surface materials in New Brunswick are available (Dept. of Natural Resources). (Some reading of the references cited will make the geochemical survey reports more meaningful).

The geochemical method of prospecting has two very important characteristics for the prospector, it is inexpensive and it is rapid as a reconnaissance 'tool'. However, in New Brunswick care must be taken to avoid 'anomalies' that are due to contamination from garbage widely and carelessly distributed. There are also many 'transported' geochemical anomalies resulting from glacial transport of mineralized boulders to positions far removed from their source.

(Geochemical maps and reports, produced in this province will be demonstrated and discussed by your instructor).

5.1.7 Recording and Presenting Data

Comments have already been made regarding the importance of carefully maintaining control of location for samples collected and observations made in the field. Returning to the field, sometimes years later, to try to find a vaguely located outcrop, that has suddenly become important, may be a difficult and frustrating exercise.

Whereas prospectors are not expected to be cartographers and authors, they can and should develop the skills required to accurately position and describe features that they have

encountered in the field.

Two records are required:

a) a topographic base (air photo and transparent overlay on it will serve) on which to depict accurately located positions in the field (at which you have made observations, collected samples, etc.), and,

b) notes that record the additional information you have collected.

An aluminum, spring-back folder is a useful, light-weight holder for both records from which, at the end of each day, or each project, the tracing and notes are removed and placed in a permanent binder. (It is unwise to carry notes and maps acquired over a long period for fear of losing them and having to repeat the work).

Locations on the map or tracing can be indicated by a dot (in ink if location is certain) and a number. This number (and a reference to the map or air photo tracing or overlay on which it is plotted) corresponds to the same in your notes where you have space to record the observations, sample data, analyses, etc. relating to that position. At some convenient time (rainy days) the location numbers ('stations') can be plotted on your compilation or an 'overlay' on it.

You may wish to use a form for your observations similar to that on the next page.

Additional notes on records will be supplied below.

Prospecting Proj. - Along Beaver Brook, from CNR crossing to Victoria Village Date:

Map (Photo) Ref.: NB-O-6, one inch equals ¼ mile Notes: J. Prospector

LOC'N	DESCRIPTION	STRIKE & DIP	SAMPLE	ANALYSES	REMARKS
21	Large outcrop (25' x 300') of gray, banded rock in which tiny specks of pyrite noted. Banding in rock 030°-40E. Sample taken for analysis gold & silver. Sample of rock for reference.	030 40	 P-81-21 " " "	(recorded later when results received) Au-0.02 oz/T Ag 3 oz/T	 Photo, close-up pyrite No. 22, Roll 81-8.
22					

5.2.0 SAMPLING

5.2.1 General Information

Sampling is the basis for evaluating and making economic decisions, over the history of a deposit, from prospect to producer. Indeed, sampling continues throughout the life of a producer and is completed only when an ore body has been mined out. The prospector's competence is related to his ability to accurately determine sample location positions in the field and plotting them on a map. The 'proof' of a prospect is in the samples taken from it. Much time and money have been wasted through improper sampling. Misunderstandings between prospectors and potential clients or partners often result from differences in the interpretation of sampling results. The history of prospecting and mining also contains many examples of attempts to mislead or misrepresent through the 'doctoring' or 'salting' of samples. Merchants, doctors, lawyers, and others, wise in the ways of business and investment in other fields, have been 'led astray' in mining promotions simply because they didn't understand the significance of an analyst's report on a prospector's sample. Too many prospectors have been similarly misled into wasting their time and energy because they did not recognize the significance of sample results.

The confusion and waste so often associated with sampling stems from ignorance, oversight and sometimes the intention to mislead. These, in turn, result from a sense of mystery and naive dependence on luck that have characterized prospecting in the past. The stories of the big 'strikes' and 'bonanzas' are commonly exaggerated out of all proportion to the 1,000's more that could be told of failure and loss. The 'mystique' often attached to prospectors' samples is all the more surprizing since sampling and interpreting results are almost always an exercise

in common sense, combined with a few basic skills. There is nothing mysterious about sampling and analyses if they are honestly and sensibly carried out and reported.

Lack of sufficient information is generally the cause of confusion or mystery about sample results. It is, therefore, as important to know what results do not tell us as it is to have some idea of what they may indicate.

Sampling is discussed in Chapter 14, p. 184 of your texts (Lang, 1970). A more advanced treatment of this subject may be found in Reference 9, (Chapter 16, p. 461). The same topic is also considered in detail in Reference 3.

Sampling will be described in these notes only in terms of the simple, relatively inexpensive, preliminary tests that will indicate whether or not a 'prospect' is worthy of serious attention. The method and quantitative thinking required are the same for more intensive and expensive sampling techniques, such as those involved in drilling, that are appropriate for larger organizations.

5.2.2 Objectives of Sampling

A 'prospect' in New Brunswick is likely to be a surface exposure of some rock (granite, sandstone, volcanic rock, etc.) in which some ore minerals (chalcopyrite, galena, molybdenite, uranite, etc.) are found. This prospect might occur in an outcrop of bedrock surrounded by soil and vegetation. The outcrop typically, might be 200 feet long and 60 feet wide. The ore mineralization might be in a 'rusty' zone, measuring about 15 feet long and 6 feet wide, parallel to the long dimension of the outcrop. Examination of solid rock from the rusty (weathered)

zone reveals, in the hand lens, what you identify as pyrite, chalcopyrite and a few flecks of galena. Much of the other material you examine in the rusty zone is soft and fine and in it you cannot recognize individual minerals. You make certain of where you are on the map or air photo (or both) and you move away from the outcrop (on compass bearings parallel, and at right angles, to the long axis of the outcrop and its mineralized zone) looking for extensions or repetitions. Lets assume that the search is unsuccessful, the surrounding areas being covered with thick overburden and vegetation through which no other outcrops appear. You return to your 'find' and note that there doesn't appear to be any evidence, in the form of broken rock surfaces, digging into the soft, rusty mineralized zone, etc., to suggest that prospectors or geologists have been there before you. You note further that the mineralized zone extends from one end of the outcrop into the overburden but attempts to trace it are thwarted by the thickness of the overburden and the abrupt termination of the outcrop in a steep surface. You're justifiably pleased with your 'find' but what is it worth? and what do you do with it?

You take a sample of the freshest (or hardest) mineralized material you can find since the visible pyrite, chalcopyrite and galena are in this, within the zone. You also collect some of the soft brownish, altered material that feels like clay. The two materials (say, about two pounds of each) are put in bags and numbered and dated. You have started the sampling process that will continue as long as this prospect is of interest.

After returning to your base and plotting the location of

your samples on your compilation, you decide to obtain an analysis of your samples after encouragement from the geologist in the DNR office. On the basis of what can be seen in your samples, you request an analysis for: gold (may be in very fine particles inside pyrite and/or chalcopyrite grains), copper (chalcopyrite), lead (galena) and silver (may occur in galena or gold). After two weeks and the payment of $20, you receive a report as follows:

	Sample 81-1 (hard)	Sample 81-2 (soft)
Au	trace	0.51 oz/T
Ag	trace	0.80 oz/T
Cu	1.5%	trace
Pb	2.9%	trace

What do the results indicate regarding the worth of your 'find'? Should you stake it? How much ground should you stake? What 'shape' should your claim group be, if you do stake? Is the material of ore grade? Why the difference between hard and soft material? How large a tonnage of this material would be required for mining? Should 'the showing' be drilled, trenched? What other sampling could or should be done? Assuming a large tonnage of this material, how would it be mined?, at what rate?, to what depth?, at what cost?. how would ore of this type be milled?, at what cost?, to produce what concentrates?, worth how much?.

The fact is that the results supplied by the analyst, in the example above, do not provide the complete answer to any of these questions nor many others that could be posed. The results cited above are at best representative of material within a few feet of the surface and from the zone of 15 x 6 feet. If the prospector

accepts and understands why the analyst's results above are an inconclusive and inadequate basis for making judgements and estimates of the ore potential of this showing, he/she is 'on the way' to understanding the sampling process and its interpretation in the evaluation of mineral deposits.

To be useful in making any estimates that include tons, metal contents, and dollar values, a sample must be representative of some significant portion of a potential ore body. In the example described, the samples have been selected from the material easily available to you. It is only common sense to expect that this altered, weathered, surface material you have collected, is different from that a few feet directly below it, where weathering agents: air, water, vegetation have had less influence. Similarly, in the description of the samples collected, there is no mention made of differences that the mineralization may show across or along the strike of the zone. Thus, the 'representativeness' of the samples for the surface area itself is in doubt.

What if anything, then, do such sample results indicate? Or have you already wasted your time and $20? No, the results are of interest and use because it is now known that significant (above the grade at which these elements are profitably recovered from some known ores) amounts of ore elements occur in outcrop. And you also know, from your examination and description of the occurrence, that the possibility for more of the material exists under the overburden and that this possibility has not been tested (by you).

Although the results from the lab indicate that Au, Ag, Cu,

and Pb are present in the samples, they do not tell you anything about other elements that could be associated with those reported. A useful preliminary test to make on any 'new' mineralization is that of a semi-quantitative 'scan' of the most common ore elements. This is done in a lab by spectragraphic or x-ray techniques at a reasonable cost. This will indicate if 'hidden' elements should be specified for more quantitative analysis.

The usefulness of your sample results lies in their qualitative rather than quantitative information. This is true even though the quantities of the ore elements is expressed in fairly exact numbers. The non-quantitative character of the results may become apparent if we look again at the numerical terms. The gold and silver are expressed in oz/T. If we were certain that your samples were representative of a ton of the zone material, we could say that the same ton would probably contain the specified amounts of Au and Ag. Your sample is really only representative of itself, as far as we know, and two pounds is not much. The fact that the two samples, taken from essentially the same place, give such different results, indicates the limits of their representativeness. In the cases of Cu and Pb, metal contents are expressed in percentages and the question should always be asked, "Percentage of what?" In the case being considered, the % applied really only to two pounds of material for each sample. Thus, though encouraging, the %'s don't really tell us much about the possibility of mining profitably. Techniques for extending the metal contents of small samples to those of tons are described in the references cited

Speculation and estimation of tonnage, grade, reserves, etc., from analytical results on the small type of 'sample' described above, should be avoided at all times because of the fact that they are unlikely to be representative of a quantity of material sufficient for mining. It is important to remember that in representativeness means that sample results may be higher, lower or equal to the grade or average assay values of a mineable tonnage.

There are two objectives in sampling:

a) Qualitative - to find out what valuable materials (ore minerals, ore elements) are present and also some information on what other (non valuable) minerals are associated with them in this occurrence.

b) Quantitative - to find out how much valuable material is present and how (spatially, not necessarily genetically) it is distributed.

The objectives of sampling, the techniques commonly employed, and the interpretation of results are fairly standard for mineral occurrences in most parts of the world and certainly within Canada.

5.2.3 Types of Samples and Methods of Collection

Types of samples, methods of collection, types of analyses, and estimation of grade/tonnage from analytical results are described in your texts (Lang, 1970) in a manner appropriate for an introduction to this very important phase of prospecting.

The prospector should appreciate that in the long and costly process of bringing a prospect up to the point at which a

decision to produce is possible, sampling proceeds throughout, in progressively more representative stages involving greater numbers and sizes of samples. Sampling is the basis upon which money is invested and returns calculated throughout the commercial life of an economic deposit.

a) Selected (Grab) Samples

The type of samples briefly described above is a preliminary test of an occurrence and should be reported as, "selected" or "grab"to indicate samples not collected in such a way as to be representative of a specific volume of rock is common. (The original and more correct meaning of 'grab' is somewhat different). Samples selected to show the minerals present and something of the nature of their intergrowths, etc., should be clearly labelled as such to avoid misunderstanding. (The instructor should expand on this topic if it is not understood).

b) Chip Samples

Chip samples collected by chipping with hammer, pick, chisel, nail, etc., in a continuous line (or as close as possible thereto), across or along a mineralized zone, for measured and reported distances, is a relatively cheap and efficient method of sampling for the prospector. The method can yield misleading results, however, where the hardness of the zone being sampled varies considerably, from place to place, along this line of the chips.

c) Channel Samples

The problem referred to in connection with chip samples is avoided when the time and effort is taken to cut a channel of uniform depth and width, along specific directions in mineralized

zones. Depending on this size of channel, mechanical equipment such as diamond saws and gasoline-driven drills and explosives may be used instead of hand tools. Prospectors sampling by this method would be well advised to qualify in the use of explosives.

d) Other Types of Samples

Bulk samples and diamond drill sampling involve techniques, budgets, and interpretations of results not likely to be attempted by the beginning prospector. Essentially, however, they all represent an attempt to achieve progressively closer correspondence between samples and the ore body to be mined.

5.2.4 Reporting Results

Prospectors should report their results carefully and strictly in verifiable terms. There are different methods and judgements used by geologists and mining engineers for estimating the average grade and tonnage of a mineral deposit that has economic possibilities.

On the other hand, the serious prospector will wish to have some idea of what his efforts and results represent, in terms of average grade for his prospect. An example follows in which four channel samples have been cut across a vein and an analysis of copper obtained for each sample. The prospector could then report his results as, "an average of 7.35% Cu over 4.25 feet". If the channels are spaced 10 feet apart, your report could state "an average of 7.35% Cu over 4.25 feet for a (strike) length of 40 feet (allowing for 5-foot extensions beyond sample 1 and 4, if these are 'open', i.e. not cut off).

Sample No.	Width (ft.)	Assay (Cu%)	Width x Assay
1	3.2	6.2	17.84
2	6.4	7.3	46.72
3	5.3	8.5	45.05
4	2.1	6.4	13.44
	17.0(a)		125.05(b)

Average: 4.25 feet 7.35% Cu (B - a)

Assay weighting for width of sample.

After: McKinstry, 1948, Mining Geology, Prentice-Hall, Inc. New York.

The result of, "av. 7.35% Cu over 4.25 feet" refers to the surface sampled and is a two-dimensional, (or area) grade estimate only. To obtain tonnage, the volume, or three-dimensional grade, must be calculated and the average specific gravity of the ore to be mined must be known or determined. A rough estimate of tonnage can be made by taking a third dimension (depth), equal to the strike length (40 feet) proven, and assumming grade to be constant over the same area at 40 feet below the surface. The volume of rock, therefore, will be 4.25 x 40 x 40 or 6800 cubic feet. A cubic foot of rock, typical of those containing copper mineralization as noted above, could weigh 170 lbs/cu. ft. Thus, your prospect, as you have sampled it, contains 6800 x 170 or 1,156,000 lbs. or 578 tons of copper-bearing rock. Tonnage calculations in the preliminary surface stages of prospecting are not very meaningful and should be left until grade at depth and along strike can be determined, usually by drilling.

If a prospector reports the type, distances and direction (relative to the strike of the mineralized zone) of his sampling and the analytical results obtained for each sample, this will be sufficient to indicate the significance of his prospect.

5.2.5 Summary

Sampling is the second most important operation undertaken by a prospector. It is time-consuming and costs of analyses (a list of local analytical services and costs will be supplied with the last session's notes) are significant in the prospector's budget. On the other hand, no meaningful estimation of a prospect's potential is possible without analytical results on carefully collected samples that are representative of a significant quantity of mineralization.